



Conservative Treatment of Distal Radius Fractures, Importance of Radial Height

Radius Alt Uç Kırıklarının Kapalı Yöntemle Tedavisi, Radius Yüksekliğinin Önemi

Conservative Treatment of Distal Radius Fractures

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Özet

Radius alt uç kırıklarının kapalı veya cerrahi tedavi kararı bazı tip kırıklarda daha zor olabilir. Kliniğimizde kapalı redüksiyon ve alçı ile takip ettiğimiz hastaları klinik ve radyolojik olarak değerlendirerek stabilite ve prognozu etkileyen başlıca faktörleri değerlendirmeyi amaçladık. Çalışmada Ocak 2007-Eylül 2010 tarihleri arasında Klinik değerlendirmede Gartland ve Werley sistemi, DASH anketi ve radyolojik değerlendirmede; artritik değişiklikler Knirk ve Jupiter artrit değerlendirme sistemi ile ve açılma Stewart radyolojik değerlendirme kriterleri ile değerlendirildi. Ondokuz Mayıs Üniversitesi Ortopedi Bölümünde kapalı redüksiyon ve alçı ile takip edilmiş 51 hasta dahil edildi (34 erkek, 17 kadın ort. Yaş 39.8 ± 11.3). Ortalama takip süresi 17.1 aydı (dağılım, 6-48 ay). Gartland ve Werley klinik değerlendirme sistemine göre 23 hasta (45.1%) 0-2 puan (mükemmel), 19 (37.3%) hasta 3-8 puan (iyi) ve 9 (17.6%) hasta 9-20 puan (orta) olarak değerlendirildi. Kötü sonuç yoktu. Radial yükseklik kaybı fonksiyonel sonuçları olumsuz etkiledi, radial yükseklik tedavinin prognozuna etki eden başlıca faktörlerden birisi olarak tespit edildi, radial inklinasyon, radial kısalık, veya palmar inklinasyon kaybı prognoza olumsuz etki etmedi.

Anahtar Kelimeler

Radius Distal Kırıkları; Kapalı Redüksiyon; Radius Yüksekliği

Abstract

Decision of conservative treatment or surgery still remains a debate for some particular types of radius distal fractures. We aimed to evaluate the clinical and radiological results of a patient group treated in our clinic with closed reduction and plaster cast fixation and tried to evaluate the prime factors affecting stability and prognosis of conservative treatment. The study comprised 51 patients (34 males, 17 females; mean age 39.8 ± 11.3 years) treated with closed reduction and plaster cast fixation for radius distal end fracture at our clinic during the period January 2007 to September 2010. Obtained clinical results were scored according to the Gartland and Werley clinical evaluation system¹² and the Disability Arm, Shoulder and Hand Surgery Questionnaire (DASH), for radiological examination; arthritic changes were evaluated according to the Knirk and Jupiter arthritis scoring system and angulation evaluation was made according to the Stewart's radiological evaluation criteria. Mean follow-up period time was 17.1 months (range, 6-48 months). According to the Gartland and Werley clinical evaluation system 23 patients had (45.1%) 0-2 points (excellent), 19 (37.3%) had 3-8 points (good) and 9 (17.6%) had 9-20 points (moderate). No poor results were determined. Loss of radial height had a negative effect on functional outcome, radial height is one of the prime factors affecting the prognosis of the treatment. Impairment of the radial inclination, radial shortening or loss of palmar inclination were not observed to negatively affect the prognosis.

Keywords

Radius Distal Fractures; Closed Reduction; Radial Height

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Introduction

Radius distal end fractures are the most frequently seen of all bone fractures and comprise 8-15% of all fractures [1]. 75-80% of radius distal end fractures are extra-articular stable fractures and can be treated conservatively in the Emergency Department [2]. However, approximately 20% of these fractures are unstable and surgical treatment is required and decision on conservative treatment or surgery still remains a debate for some particular types of fractures [1,2]. In the choice of treatment methods, factors such as the type of fracture, the patient's age, lifestyle, accompanying health problems, compliance to treatment, physical and mental capacity must be considered [3,4]. Depending on the physician's experience and the facilities available, several methods including simple plaster cast or percutaneous nailing, various external and internal fixation and grafting techniques can be used. The basic principles of treatment are to obtain the most appropriate reduction and the fixation of this reduction [5].

This retrospective study aimed to evaluate the functional and radiological results of a patient group treated in our clinic with closed reduction and plaster cast fixation for distal radius fracture and to evaluate the prime factors affecting stability and prognosis of conservative treatment.

Material and Method

Local ethics committee approval from Ondokuz Mayıs University and written informed consent was obtained for the study. This retrospective study comprised 51 patients (34 males, 17 females; mean age 39.8 ± 11.3 years) treated with closed reduction and plaster cast fixation for radius distal end fracture at our clinic during the period January 2007 to September 2010. Patient selection criteria were, i) to have been treated and followed up at our clinic, ii) aged over 18 years, iii) pre and post-treatment radiographs available, iv) to have had a final clinical evaluation after at least 6 months polyclinic follow-up, v) to have been diagnosed with distal radius fracture which was treated with closed reduction and plaster casting. During the reduction manoeuvre made to patients presenting with a radius distal end fracture, analgesia was administered to patients who could not tolerate the pain (those with cardiovascular diseases, hypertension or those who stated that they would not be able to tolerate pain). A singular dose of intramuscular Diclofenac Na or Metamizol Na was administered as analgesia and intramuscular Diazepam (10mg) as sedative. With the patient in a supine position and the affected arm in abduction with the elbow at 90° flexion, one assistant applied traction above the elbow (opposite traction) and another person applied traction holding the thumb in one hand and the 4 fingers in the other. After 2-3 minutes of continuous traction, the reduction manoeuvre was made according to the fracture type and estimated mechanism of the fracture.

An above-the-elbow brace which allowed movement of the metacarpophalangeal joint was applied to all patients. At this stage, the standard position for the wrist was not used but care was taken to apply the brace in the position in which reduction was made.

That the reduction was within acceptable measurements was checked by post-reduction radiographs. The patients were

called to follow-up one day later to inform them about brace complications and compartment syndrome. For patients where the oedema had reduced, radiographs were repeated within the brace and if the reduction was protected, an above-the-elbow plaster cast was applied and radiographs were repeated after the plaster casting. For patients with continuing oedema, elevation was explained again and they were called for frequent follow-ups until the oedema had recovered and the above-mentioned procedure for a circular plaster cast was applied. After the application of a circular plaster cast, circulation follow-up and elevation were explained and they were called for follow-up 2 days later for circulation monitoring. Patients with good circulation had follow-up radiographs taken after 4 weeks and the plaster cast was removed to below the elbow. They were followed up in this way for 2 weeks. At this stage, elbow exercises were recommended to the patients. At the end of 6 weeks, the plaster cast was removed and radiological and clinical examinations were made. For rehabilitation, isotonic and isometric wrist, finger and elbow exercises were taught to the patients.

At the final follow-up, the patients were questioned about any complaints. The wrist shape, forearm rotation and wrist movements were examined in the clinical examination. Grip strength was measured comparatively with a dynamometer (Jamar, Baseline hydraulic hand dynamometer, Irvington, NY, USA) with the elbow at 90° and the forearm and wrist in a neutral position. In this measurement, the gripping arm is held tight and gripping force is applied at a single time by the patient using maximum strength. The test was applied by making two measurements for each hand alternately. Each force was recorded. There may be 5-10% difference between the dominant and non-dominant hand. The obtained clinical results were scored according to the Gartland and Werley clinical evaluation system [12]. For the final evaluation the patients were questioned using the Disability Arm, Shoulder and Hand Surgery Questionnaire (DASH), which consists of 30 questions. Of these 30 questions, 21 evaluate daily activities of the patients, 5 are related to symptoms and 1 to sleep. In this system, no complaint or performing the specified activity without any difficulty is scored as 1 and excessive complaints or inability to perform the activity as 5 [6].

At the same time, anterior-posterior and lateral radiographs of the wrist were taken. In the radiological examination, arthritic changes were evaluated according to the Knirk and Jupiter arthritis scoring system [4]. and angulation evaluation was made according to the Stewart et al radiological evaluation criteria [7]. In addition, the patients were evaluated by direct radiographs taken after plaster casting using the above-mentioned scoring systems.

Results

The mean follow-up period of the 51 patients in the study was 17.1 months (range, 6-48 months). Distribution of the patients according to the Frykman and AO Classifications is shown in Table 1.

According to the Gartland and Werley clinical evaluation system the patients were evaluated as 23 (45.1%) at 0-2 points (excellent), 19 (37.3%) at 3-8 points (good) and 9 (17.6%) at 9-20 points (moderate). No poor results were determined.

The mean DASH score was 35.9 ± 4.2 . When muscle strength

Table 1. Distribution according to Frykman and AO Classifications

Frykman classification	No of patients	%	AO classification	No of patients	%
I	5	9.8	A2	19	37.3
II	1	2.0	A3	12	23.5
III	7	13.7	B1	9	17.6
IV	3	5.9	C1	8	15.7
V	13	25.5	C2	3	5.9
VI	11	21.6			
VII	5	9.8			
VIII	6	11.8			
TOTAL	51	100	TOTAL	51	100

was compared with the healthy side, the healthy side was found to be mean 34.1 ± 10.0 kg, and the fractured side, 27.9 ± 9.6 kg. Preoperative mean radial height was 12 mm. Postoperative mean radial length was measured to be 11.8 mm. Total of 6 patients had decreased radial heights and mean muscle strengths of these 6 patients was found to be 22.5 this value was found to be statistically significantly lower than patients who had post-treatment normal radial heights. ($p < 0.05$).

When the patients were examined according to the Stewart et al radiological criteria, results were obtained of 18 (35.3%) excellent, 28 (54.9%) good and 9 (17.6%) moderate. No poor results were obtained.

Osteoarthritis was determined radiologically in 14 (27.4%) patients according to the Knirk and Jupiter arthritis scoring system. Of 11 patients determined with Grade 1 arthritis, 4 (36.3%) fractures were Frykman Type 7, 5 (45.4%) Frykman Type 8, 1 (9%) Frykman Type 3 and 1 (9%) Frykman Type 4. Of the 3 patients determined with Grade 2 arthritis, 1 fracture was Frykman Type 7 and 2 fractures were Frykman Type 6. In addition, it was determined that as the Frykman degree increased so there was an increase in clinical score, DASH and the radiological anatomic score.

32-year old male with left side radius distal end complex fracture, Frykman Type 6, AO A3, AP and Lateral Roentgenogram before closed reduction (Figure 1), after closed reduction (Figure 2) and after follow-up period of 10 months (Figure 3).

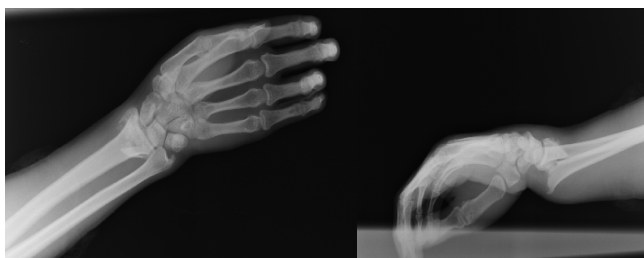


Figure 1. 32-year old male with left side radius distal end complex fracture, Frykman Type 6, AO A3, AP and Lateral Roentgenogram before closed reduction.

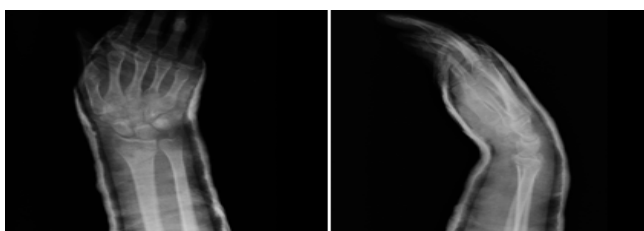


Figure 2. After closed reduction



Figure 3. After follow-up period of 10 months

Discussion

Radius distal end fractures are fractures which are anatomically in the distal of the distal radius metaphysis. Although these are the most frequently encountered fractures during an orthopaedic career, there is still no consensus on classification, treatment and the evaluation of treatment results.

To obtain good functional results in radius distal end fractures it is necessary to correct radial shortness, radial inclination, dorsal curve and distal radioulnar joint incongruity.

In a study by Karalezli et al, anatomic results of 40.7% excellent, 44.4% good, 9.9% fair and 5% poor were obtained according to the Stewart score system, clinical results of 30.8% excellent, 47% good, 17.2% fair and 5.0% poor and it was advocated that to achieve a good functional result, it is necessary to obtain a good anatomic result [8]. In the current study, when the results obtained were evaluated, it was determined that as the anatomic result worsened so the clinical result also worsened. In addition, patients who did not have good functional and anatomic results had a high DASH score.

In the treatment of radius distal fractures, it is still a matter of debate as to which is the most important criteria defining prognosis of the result of reduction. According to Palmer, it is the restoration of radial length, while Gartland and Werley reported it to be the presence of residual dorsal tilt [9,10]. Fernandez et al stated that dorsal angulation $>25^\circ$ will negatively affect the prognosis and Pogue et al claimed that more than 20° will lead to poor results [11,12]. Frykman and de Palma reported that it is necessary to provide radial length to be able to obtain good functional results [10,13]. In the current study, that loss of radial height had a negative effect on both grip strength and clinical results, supports the view that radial height is the most important criteria defining the prognosis of the treatment. Impairment of the radial inclination, radial shortening or loss of palmar inclination were not observed to negatively affect the prognosis.

In a study by Vural et al where a comparison was made of the Kapandji technique with plaster casting, there was no difference between the groups in respect of radial length and radial inclination but palmar inclination was determined to have been better restored in the Kapandji technique [14]. In the current study, when evaluation was made of the final follow-up measurements of all the patients, the mean radial curve angle was found to be $19.4 \pm 4.4^\circ$, the mean palmar curve angle $0.3 \pm 8.5^\circ$ and radial height 8.5 ± 2.6 mm. According to these results from the current study, it was concluded that the palmar inclination angle was more difficult to correct than the other angles, although as the most obvious limitation of this study is that there was no control group, we are in support of further studies to be made on the subject of by which method the palmar inclination

can be corrected.

It is known that when the treatment of radius distal fractures results in insufficient anatomic restoration, this creates a loss of grip strength. McQueen found more than 2mm shortening in the radius to be an indicator of grip strength loss [15]. In a study by Özdemir et al, while it was observed that as angulation increased dorsally, grip strength decreased, no relationship was found between the radial angle and grip strength [16]. In the current study, in the correlation between grip strength and radius distal end anatomy, the conclusion was reached that as radial length decreased, so grip strength also decreased. No significance was found between grip strength and radial and palmar inclination.

One of the most frequently encountered problems in conservative follow-up of radius distal end fractures is that the reduction is not protected inside the plaster cast. This problem is more evident particularly in unstable fractures [17]. It has become known that even if there is successful reduction initially in radius distal end fractures with metaphyseal fragmentation, loss of reduction develops inside the plaster cast in approximately 60% of these cases [18]. In this respect, these fractures require careful monitoring in conservative follow-up with plaster cast. Jenkins et al reported that reduction loss of 5% was observed as a result of conservative treatment in unstable intra-articular fractures and this required correction with a new reduction [19]. In a study by Warwick with a 10-year follow-up period, it was reported that plaster casting treatment could not provide sufficient radial length and thus external fixators should be preferred [20].

In the current study, anatomic angles were measured following plaster casting and at the final follow-up. In the light of these values, the radial inclination angle and radial height within the plaster cast were found to be statistically significantly higher than the values measured at the final follow-up. However, no significant difference was found between the value of the palmar tilt angle in the plaster cast and that at the follow-up following bone union. In addition, while the radial height and radial inclination values in the plaster cast of elderly patients and those with metaphyseal fragmentation were found to be significantly higher than the follow-up values, no statistically significant difference was determined in the palmar tilt. That no difference was determined between the palmar tilt angles in the plaster cast and at follow-up is thought to be associated with the provision of sufficient support from the dorsal of the plaster cast which was applied after oedema had recovered. However, osteopenic fractures in elderly patients have a tendency to displacement particularly in the late period and this can be considered to conform with the view of Warwick that plaster casting treatment cannot provide sufficient radial length [20,21].

Another subject for debate in radius distal fractures is the effect on prognosis of an ulnar styloid fracture together with a radius fracture. According to Knirk et al, non-union of the styloid affects the prognosis negatively [4]. Smaill et al reported that an ulnar styloid fracture may cause restricted wrist movement [22]. However, in a study by Bradway et al, it was stated that non-union of an ulnar styloid fracture did not affect functional results. [23]. In the current study, 21 (41.1%) patients had an

ulnar styloid fracture as well as the radius distal fracture. At the final follow-up, union of the ulnar styloid was determined in 6 (28.5%) patients and non-union in 15 (71.5%) patients. Although the number of patients was low in the current study, as there was no statistically significant difference in the follow-up mean clinical evaluation score and DASH score between the patients with union of the ulnar styloid and those with non-union, the presence of a styloid fracture was not thought to affect the functional results.

Conclusion

The currently accepted view of radius distal end fractures is that they are complex fractures and prognosis varies depending on the type of fracture and the treatment applied. Treatment with closed reduction and plaster cast fixation is extremely cheap and is an easy method to apply in a short time. In the current study, that loss of radial height had a negative effect on both grip strength and clinical results, supports the view that radial height is the most important criteria defining the prognosis of the treatment. Impairment of the radial inclination, radial shortening or loss of palmar inclination were not observed to negatively affect the prognosis.

Competing interests

The authors declare that they have no competing interests.

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